

Final FRCS vascular clinicals

The current format of the Final FRCS clinical examination for vascular candidates consists of both general surgery and vascular clinicals. These examinations have the same layout, and are taken on the same day. Each clinical consists of a series of five short stations taken in rapid succession. For each examination there are two examiners who will take turns in questioning and marking the candidate. The cases are either a patient encounter or interpreting an investigation. With the final examination being directed at ascertaining competence to become a consultant, the questions tend to relate to management issues rather than testing your ability to perform a head-to-toe clinical assessment. However, as senior trainees it is expected that you should know how to examine a patient in an orderly and effective fashion. Failure to demonstrate this in the clinical encounters will ring alarm bells with the examiners.

The short case format of the clinicals should not be viewed as a hurdle, but rather as an opportunity for you to impart your fundamental knowledge on a broad range of topics. The examination process is an efficient way of assessing a wide range of subjects in a limited period of time, in a systematic manner. Candidates who have gone through the clinicals are often left stunned by the number of topics that have been discussed in a blur of 30 minutes. Candidates should therefore see the benefits of this system where a poor performance for one case becomes a small part of the whole marking scheme. It is essential that candidates who feel that they have done badly at one station do not dwell on their misfortune, but compose themselves and get on with the rest of the assessment believing they can still pass.

It is important that as the candidate you listen carefully to the examiner's questions. The instructions will often be extremely focused, and initially seem quite a minor request. The initial 'starter' question will then lead on to more complex issues. The questions are generally not intended to catch you out, so do what you are asked to do. It is essential that you appear comfortable dealing with patients. Although observed examination practice with colleagues is very useful, it can also be helpful to get into a habit of examining patients in outpatient clinics in the same systematic manner as you would use in the examination. Your actions will then become effortless and automatic in the high adrenaline situation of the examination. It is important to get over the 'pass/fail' information and common conditions before moving on to rarities. As the clinical examinations and vivas all depend on verbal interaction to impart your knowledge, it is vitally important to practice viva questioning with colleagues. This will help you formulate a structure to your answers in an orderly fashion, and you should quickly notice an improvement in your performance.

When anticipating cases for your clinical examination, common conditions in mobile patients will appear most frequently. If you have ever been in the situation of organising patients for a clinical examination you realise that the mobile elderly and those with stable 2

Cambridge University Press 978-0-521-13352-4 - Postgraduate Vascular Surgery: The Candidate's Guide to the FRCS Edited by Vish Bhattacharya and Gerard Stansby Excerpt More information

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chronic disease are easiest to recruit. There will always be a small pool of rarities such as Klippel–Trénaunay syndrome or carotid body tumours that are willing to turn up for examinations. It would be extremely unusual for an acute life-, or limb-threatening problem to turn up to an examination. When performing the clinicals try to smile when introducing yourself to the patients and thank the patients following the encounter (the same applies to thanking the examiners!). The examination day can actually become quite repetitive for the patients and examiners alike. Try hard to make them feel that their participation is valued, and demonstrate that you can put patients at their ease.

Last minute revision can be helpful as topics recently read have a habit of turning up in examinations. Despite this, turning up to the examination sleep deprived will not help your performance; hence a sensible balance must be met. Research has demonstrated that moderate sleep deprivation produces impaired cognitive and motor performance similar to alcohol intoxication. You would not expect to pass an examination whilst intoxicated!



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Introduction to the examination and clinical cases

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Popliteal aneurysm

The basics

Popliteal aneurysms (PAs) are the commonest peripheral aneurysm (Figure I.1). Approximately half are bilateral and half are associated with an aortic aneurysm. Conversely, 5–10% of patients with an abdominal aortic aneurysm (AAA) have a PA. The majority of PAs present with distal ischaemic complications in either the acute or chronic situation. The prevalence of the PA is thought to be around 1% for those in their eighth decade. When presenting acutely with distal limb ischaemia, limb loss occurs in up to 50% of cases. PAs almost exclusively occur in males. When treatment is indicated PAs are generally treated by surgical exclusion although endovascular management is a newer development in selected cases. Occasionally patients with patent PAs and very diseased run-off may be managed long term with anticoagulation to reduce the risk of aneurysm thrombosis.

The case

Popliteal aneurysms are usually easy to identify as an expansile, or prominent, pulsation in the popliteal fossa. The artery is best palpated against the tibia in the midline of the popliteal fossa, with the knee in the extended position (or with a few degrees of flexion). The artery can also be palpated with the knee flexed to 130°; in this position the popliteal fascia loosens to aid palpation. However, in doing so the manoeuvre deepens the artery from the skin surface. When thrombosed, PAs may be more difficult to diagnose clinically. It is important to assess the distal circulation for evidence of embolisation into the foot or calf vessels. Other posterior knee swellings include a Baker's cyst or a semimembranosus bursa. Remember a PA can exist at any point along the course of the popliteal artery and include the lower SFA as well. In contrast, Baker's cyst originates below the level of the knee joint as it extends beneath the gastrocnemius muscle. A Baker's cyst will often be associated with symptoms and signs suggestive of degenerative arthritis of the knee joint. When present, an enlarged semimembranosus muscle.

Questions

How do PAs present?

In the acute situation PAs usually present with distal ischaemia as a consequence of acute thrombosis or distal embolisation. In the chronic situation they present with intermittent

Postgraduate Vascular Surgery: The Candidate's Guide to the FRCS, eds. Vish Bhattacharya and Gerard Stansby. Published by Cambridge University Press. © Cambridge University Press 2010.

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Figure I.1 Angiographic image of a popliteal aneurysm.

claudication as a result of chronic embolisation to the tibial vessels. Asymptomatic PAs are often identified when screening patients with known aortic aneurysms. In contrast to aortic aneurysms, rupture of a PA is a relatively rare occurrence (<5%). Other rarer presentations result from local pressure on surrounding nerves and/or popliteal vein, and they can be the cause of a deep vein thrombosis (DVT).

Tell me about the anatomy of the popliteal artery?

The popliteal artery commences when the femoral artery passes through the adductor hiatus in the thigh. The vessel terminates as it splits into the anterior tibial artery and tibioperoneal trunk at the lower border of popliteus muscle. The popliteal artery gives off genicular branches at several levels to form a large collateral network about the knee joint. The artery is the deepest major structure in the popliteal fossa, and sits beneath the popliteal vein. The tibial nerve lies superficial to the popliteal vein. This organisation is not in the classical vein/artery/nerve configuration.

How would you approach the proximal and distal popliteal artery?

Although the popliteal artery can be approached via posterior or lateral incisions, the most common routes of proximal and distal access are via the medial approach. The suprageniculate artery is accessed via an incision in the distal third of thigh along the anterior border of the sartorius muscle. This muscle is mobilised posterior and the artery is identified between the medial intramuscular septum anteriorly and semimembranosus muscle posteriorly. The infrageniculate popliteal artery is exposed medially via a longitudinal incision, 1 cm behind the posterior/medial border of the tibia. The long saphenous vein (LSV) is usually located posterior to the incision, and care must me made not to damage it! A tissue plane is bluntly created between the soleus and gastrocnemius muscles. The tendons of sartorius, gracilis and semitendinosus often require division for more proximal access. The popliteal vein must be mobilised as this sits in front of the artery from the medial approach.

What are your indications for elective repair?

In contrast to AAAs, where there is clear consensus on indications for intervention in terms of size, this is not the case for PAs. Most surgeons would treat PAs exceeding 2 cm in

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diameter although patient factors may influence the decision for intervention. These factors may include patient fitness, the anatomical configuration of the PA, evidence of distal embolisation or the presence of critical ischaemia. Most surgeons would view distal embolisation as a strong indicator for treatment, irrespective of aneurysm size. The presence of mural thrombus on Duplex scanning, and significant distortion of the aneurysm should be viewed as concerning signs. Prevention of aneurysm thrombosis is critical as limb loss is markedly worse in the acute setting than for elective surgery.

When is thrombolysis utilised?

It has been observed that catheter based thrombolysis is associated with higher risks of ischaemic complications when used to manage acute PAs in comparison to treating an acute graft occlusion. During the lysis process a large volume of thromboembolic material is destabilised and inevitably embolised distally. Studies have demonstrated that in at least 10% of patients the limb acutely deteriorates during the lysis process. The main role of thrombolysis is 'on table' to clear thrombus from the run-off vessels during the process of surgical revascularisation. Thrombolysis can sometimes be used where no distal target vessels are seen for surgical bypass on initial angiography and the limb is only in the 'marginally' threatened category.

What major problem faces endovascular treatment of PAs?

It is without doubt that covered endovascular stents can effectively exclude PAs and provide an adequate conduit to supply blood to the lower leg. The main concerns regarding popliteal stent grafts relate to their long-term durability. With the constant flexing of the knee joint, the physical stresses challenge the integrity and positioning of popliteal stent grafts. Endovascular exclusion was first described in 1994, and most of the literature reports come from institutional case series. Endovascular treatment was mainly performed in asymptomatic patients, and initial results were poor. With the development of newer, more flexible devices these results have improved, with 5-year patency rates of >75% being published.

Carotid body tumour

The basics

Carotid body tumours (CBTs) are paragangliomas derived from the neural crest ectoderm. Paragangliomas are a rare neoplasm that can be found in the abdomen, thorax, and head and neck region. They are usually considered benign and complete surgical removal results in cure. The rule of '5%' is often quoted as 5% are bilateral, 5% familial, 5% systemically malignant and 5% locally reoccur. In reality nearer 10% are familial and in these patients one-third have bilateral tumours. In contrast to retroperitoneal paragangliomas, where the majority are hormonally active, <5% of CBTs are hormonally activity. In the neck paragangliomas can also arise from the vagus nerve (glomus vagale), and jugular bulb (glomus jugulare). There are three distinct groups of patients: sporadic (majority); familial; and hyperplastic (associated with chronic hypoxia).

The case

The thought of a CBT in your final examination might overwhelm you with fear, but it shouldn't! With their management being a relatively specialised subject you will not be expected to know a large amount about CBTs or to have treated one. Twenty minutes

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reading will provide you with all the knowledge you need to impress the examiners. The examination case will take the form of a neck mass, postoperative case and/or a computed tomography (CT)/magenetic resonance (MR) scan to review. The mass will be palpated at the level of (or above) the hyoid bone, along the anterior border of sternocleidomastoid. The CBT is firm in consistency and hence often referred to as a 'potato tumour', the mass is laterally mobile but vertically fixed. The tumour is itself not pulsatile although a transmitted pulsation may be present, or a pulsation may be palpable from an overlying external carotid artery. Differential diagnoses to consider are cervical lymphadenopathy (are there nodes elsewhere?), branchial cyst, carotid artery aneurysm (expansile mass), carotid artery tortuosity or other cervical paragangliomas. Due to the anatomical distortion and intraoperative bleeding, cranial nerve injury is more common when treating CBTs than during carotid endarterectomy (glossopharyngeal, vagus [including laryngeal branches], hypoglossal, accessory).

Questions

How do CBTs usually present?

A CBT usually presents as a painless neck mass (>50%), and can also present with compression of local structures or pain. The most common nerves to be compressed are the glossopharyngeal, vagus and hypoglossal nerves. CBTs rarely present with symptoms of cerebral ischaemia.

What are the typical CT/MR findings?

Due to the location of the CBT they typically splay the carotid bifurcation on angiography (arterial/CT or MR) – Figure I.2. If the tumour does not display this feature it is more likely to be another type of paraganglioma. The tumour derives its blood supply from the external carotid artery. The tumours are usually well defined, and when large can encase the carotid vessels.

What is the preoperative assessment?

All patients should have had a Duplex scan and neurological examination as part of their initial investigations. Further investigations include laryngoscopy (vocal cord assessment), plus selective catecholamine screening in patients experiencing hypertensive episodes or those with other neuroendocrine tumours (and contralateral CBTs on imaging). Magnetic resonance imaging (MRI) scanning is valuable for diagnostic purposes, and to identify the cranial limits of the tumour. Angiography is useful with larger tumours to identify their blood supply.

What classification system is used for CBTs?

The Shamblin classification (I to III) is used to stratify CBTs. Shamblin I tumours are small and easily dissected from the vessel wall, Shamblin II tumours are of medium size and partially encircle the carotid vessels. Shamblin III tumours are large (>4 cm) and more completely encircle the carotid vessels. The Shamblin class III tumours classically require excision and a vascular reconstruction with an interposition graft.

What endovascular interventions can be helpful in managing large tumours?

CBTs have a rich blood supply, and can be associated with significant perioperative blood loss. In addition, operative bleeding can make a safe dissection more difficult. The tumours

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Figure 1.2 Intra-arterial angiography of carotid body tumour. Note splaying of the carotid bifurcation and high vascularity of the tumour.

derive their blood supply from external carotid artery branches. Preoperative tumour embolisation, or covered stent placement over the external carotid artery feeding vessels, have both been advocated to reduce bleeding for particularly large tumours. Both of these options remain controversial as they both pose a small risk of cerebral embolisation.

Femoral anastomotic pseudoaneurysms

The basics

Femoral anastomotic pseudoaneurysms (FAPs) often occur as a consequence of previous aortobifemoral bypass surgery (Figure I.3(a) and (b)). The relationship of the anastomosis to a constantly moving hip joint may be a contributory factor in the degeneration of the arterial wall at the site of the anastomosis. Compliance may also be an issue in the pathogenesis of FAPs at the junction between the elastic artery and an inelastic prosthetic material. Their incidence at 5 years is around 5–10%; studies with longer-term follow up naturally demonstrate higher occurrence for FAPs.

Continued smoking and wound infection at the time of the original operation are thought to be risk factors for FAP development. In the case of aortobifemoral surgery the aneurysms are often bilateral.

The case

FAPs are an ideal examination case with their chronic nature and obvious clinical signs. On clinical examination femoral anastomotic pseudoaneurysms are easy to palpate due to

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Figure 1.3 Femoral anastomotic pseudoaneurysms. (a) Visible on bilateral groin inspection as late consequence of aortobifemoral surgery. (b) Angiogram of same patient, demonstrating bilateral femoral artery aneurysms. Note full length bilateral superficial femoral artery occlusions.

(a)



their superficial location. The leg and abdomen should be inspected for scars from the previous surgery. The main differential diagnoses are of other aneurysm of the femoral artery including atherosclerotic, mycotic, traumatic (including iatrogenic) and aneurysms related to connective tissue disorders.

Questions

How do FAPs present?

FAPs usually present with a visible or palpable pulsatile groin lump. Due to local pressure effects the patient can experience pain from peripheral nerve irritation (mass effect). Patients may also present less frequently with distal embolisation, rupture and aneurysm thrombosis.

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What factors predispose to FAP formation?

Factors that may predispose to FAP formation include infection (early and late), poor surgical techniques (i.e. inadequate tissue bites, undue graft tension), concomitant endarterectomy, and the continued processes of arterial degeneration from atherosclerosis (hence promoted by continued smoking).

What are your indications for surgery?

Aneurysms >2-3 cm (debatable) in diameter should be considered for surgery. Patient factors and rate of growth may influence the size for intervention. The presence of distal embolisation should lower the threshold for repair.

What is your approach to surgical repair?

The approach to surgical repair will be influenced by evidence of an infective process in the aneurysm or groin. For chronic FAPs where infection is not suspected the aneurysm can be repaired by placement of an interposition graft between graft and normal native artery. The aneurysm should be controlled proximally and distally and the aneurysm should be opened throughout its length. The anastomosis should be tension free and good bites of healthy arterial wall should be taken. Foggarty occlusion balloons may be useful for controlling back-bleeding side branches, as scarring in the groin may have made the initial dissection difficult. For cases where infection is evident the surgery should be performed through healthy tissue using an autologous conduit where possible. In all cases tissue should be sent for culture. The laboratory should be made aware that slow growing bacteria such as staphylococcus epidermidis may be implicated. Antibiotic therapy should be discussed with the microbiologists and reflect the likely causative organisms in your local area.

Vascular access

The basics

Dialysis utilising arteriovenous fistulae has been practiced since the 1960s. The classical Cimino-Brescia fistula connects the radial artery to the cephalic vein at the wrist level. For use as a dialysis conduit, flow rates of at least 200 ml min⁻¹ are required and there needs to be a suitable length of vein for access. Preoperative Duplex scanning should be performed in the presence of poor peripheral pulses, equivocal veins, failed fistula in the limb, a previous subclavian catheter or signs of proximal venous obstruction.

The case

The autologous arteriovenous (AV) fistula is the preferred method of dialysis in patients with long-term, end-stage renal failure. In the examination you may be presented with an arm to examine in a patient with an AV fistula. On inspection the arm should examined for dilated superficial veins and scars from a current (or previous) fistula. The arm should be inspected for scarring consistent with current needle punctures for dialysis. It is also important to examine the arm for evidence of distal ischaemia, particularly in the digits. On palpation the fistula should have a palpable 'thrill', or if occluded a thrombosed vein may be palpable. The distal pulses should be assessed. On auscultation a machinery murmur will be

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audible if the flow is sufficient. Proximal to the fistula there should be a sufficient length of vein for two needle dialysis.

Questions

What is the preferred location for a primary AV fistula?

The preferred location for an AV fistula is as distal as possible (artery and veins permitting) in the non-dominant arm. Although many surgeons utilise the radial artery and cephalic vein at the wrist for primary fistulae, some surgeons have demonstrated good results with fistulae made with these vessels in the anatomical snuff box. Distal sites are utilised to allow new fistulae to be created at more proximal locations in the case of fistula failure, plus a lower risk of distal ischaemia. The non-dominant arm is used to allow the recipient to perform activities during the dialysis process. Use of the non-dominant arm also means that if any complications occur as a consequence of the intervention they will have a lesser impact on the patient's function.

What findings on palpation can suggest that a fistula is at risk?

In a fistula functioning for dialysis a thrill will be easily palpable in the majority of cases. The presence of a weak thrill suggests the presence of inflow disease or narrowing at the site of the anastomosis. Pulsatility in the fistula suggests the presence of a stenosis or occlusion in the venous run-off. If a thrill is unclear in the examination you should also listen with a stethoscope.

Why is cardiac failure problematic in patients with AV fistulae?

Most fistulae used for dialysis have a blood flow of 500–1000 ml min⁻¹. In patients with more proximal fistulae, such as those in the antecubital fossa, the flow rates may be even higher than this. These high flow rates can be demanding on patients with existing cardiac failure. High-output cardiac failure can be diagnosed by observing a fall in pulse rate on manual occlusion of the fistula (Branham's sign). Patients with poor cardiac output will also be at risk of fistula occlusion or insufficient flow for effective dialysis from poor flow.

What are the complications of an AV fistula?

- Bleeding bleeding can occur in the postoperative period from the anastomosis or divided vessels. Early exploration is advocated if there is any concern that the pressure effects from the haematoma could compromise the fistula.
- Thrombosis early thrombosis can occur due to technical problems with the anastomosis or underlying arterial or venous disease. Re-exploration has been advocated to correct these technical issues unless there is evidence of non-correctible arterial or venous problems at the time of the operation. This view has been challenged by others with the observation that re-explored fistulae often re-thrombosis, hence, the creation of a new fistula at a more proximal location may be a better option.
- Failure to mature an autologous AV fistula requires time for remodelling and venous dilatation prior to commencement of dialysis. This should be at least 4–6 weeks. In fistulae that remain small and have a poor flow investigations should be performed to look for an underlying reversible cause.
- Steal steal occurs more commonly in proximal than distal fistulae. Treatment can involve surgical narrowing of the fistula or ligation or ligation of the retrograde blood